NU-01021

VERIFICATION OF TRANSLATION

I, the below named translator, hereby declare that:

My name and post office address are as stated below:

That I am knowledgeable in the English language and in the Japanese language in which the below identified Japanese application was filed, and that I believe the attached English translation of the Japanese application No. 2000-311045 is a true and complete translation of the above identified Japanese application as filed.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: November 15, 2004

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[Document Name] SPECIFICATION

[Title of the Invention] xDSL TRANSMISSION CHARACTERISTIC IMPROVING METHOD AND xDSL CHARACTERISTIC TRANSMISSION MEASURING METHOD

[Claims]

[Claim 1] An xDSL transmission characteristic improving method for improving a transmission characteristic of an xDSL system that implements high-speed data communication over existing copper wires connecting an office and a subscriber, characterized in that an office pulls, before connection of a subscriber line to said xDSL system, said subscriber line at an outside line of an xDSL circuit, measures a cross-talk noise characteristic of said subscriber line, and prevents, if said cross-talk noise characteristic is of high level, said subscriber line from being connected to said xDSL circuit.

[Claim 2] The xDSL transmission characteristic improving method as claimed in claim 1, characterized in that a level of cross-talk noise on the subscriber line is transformed to a noise spectrum by fast Fourier transform, and in that said noise spectrum data is compared with a template for noise level decision, which is weighted at a subject frequency, to thereby determine whether or not said subscriber line is usable.

[Claim 3] In xDSL for implementing high-speed data communication over existing copper wires connecting an office and a subscriber, an xDSL characteristic measuring system characterized by comprising pulling means included in an outside line of an xDSL circuit installed in an office for pulling a subscriber line, noise level measuring means for measuring a level of cross-talk noise on the subscriber line, and decision means for determining, based on the level of cross-talk noise measured, whether or not the subscriber line is usable.

[Claim 4] The xDSL transmission characteristic measuring system as claimed in claim 3, characterized in that said pulling means comprises an MDF connected to terminals T and R of the outside line at a subscriber side, relays connected to said MDF and connecting the terminals T and R to test terminals.

[Claim 5] The xDSL transmission characteristic measuring system as claimed in claim 3 or 4, characterized in that said noise level measuring means comprises a voltage measuring circuit for measuring a cross-talk noise voltage input via said relays, an /AD converting circuit for converting cross-talk noise voltage measured to a digital signal, and an FFT circuit for transforming the digital signal to noise spectrum data.

[Claim 6] The xDSL transmission characteristic measuring system as claimed in claim 5, characterized in that said decision means comprises means for comparing the noise spectrum data with a template for noise level decision to thereby determining whether or not the subscriber line is usable.

[Detailed Description of the Invention]

[0001]

[Detailed Description of the Invention]

The present invention relates to a method of improving the transmission characteristics of xDSL (x digital subscriber line; high-speed subscriber line digital transmission system) that effects high-speed data communication over existing telephone lines implemented by copper wires and connecting an office and subscribers and more particularly to a measure against cross-talk noise on xDSL channels.

[0002]

[Prior Art]

The characteristics of xDSL channels deteriorate due to cross-talk ascribable to high-speed transmission relying on metallic cables, as has been pointed out in the past. A measure against cross-talk noise is particularly essential with an xDSL system in which cross talk ascribable to an ISDN (Integrated Services Digital Network) occurs in an xDSL transmission frequency band.

[0003]

FIG. 2 shows frequency bands assigned to DMT (Discrete Multi-Tone), TCM-ISDN, ADSL (Asynchronous DSL) and SDSL. As shown, the xDSL systems use frequency bands overlapping each other as well as frequency bands

assigned to the other high-speed communication systems. As a result, the characteristic of each xDSL channel deteriorates due to cross-talk noise ascribable to TCM-ISDN channels and other xDSL channels.

[0004]

Generally, frequency bands assigned to xDSL systems partly overlap each other and frequency bands assigned to other high-speed communication systems including a TCM-ISDN (Time Compression Multiplexing-ISDN) system. The characteristics of each xDSL system therefore deteriorates due to cross-talk noise introduced from the other high-speed communication systems. In light of this, it has been proposed to confirm the characteristics of an xDSL channel via confirming means that faces a terminated device at the subscriber side of a subscriber line, which accommodates an xDSL subscriber, thereby selecting a channel suffering from a minimum of cross talk. Japanese Patent Laid-Open Publication Nos. 10-303872 and 2000-32096, for example, each propose to reduce cross talk by causing an xDSL channel to operate in synchronism with a TCM-ISDN transmission/receipt window.

[0005]

[Problem to Be Solved by the Invention]

The confirming means, however, needs a considerable period of time for selecting a channel suffering from a minimum of cross talk. The synchronous operation scheme taught in the above Laid-Open Publications applies TCM to existing xDSL systems directed toward full-duplex data transmission. This kind of scheme is therefore not practicable without changing the xDSL transmission system itself.

[0006]

It is an object of the present invention to provide a method of measuring and improving an xDSL transmission characteristic allowing xDSL channels to be selectively used and easily confirming the characteristics of the individual xDSL channel without resorting to any change or modification of the xDSL transmission system.

[0007]

[Means for Solving Problem]

As FIG. 2 indicates, part of the frequency band used by xDSL is commonly applicable to various communication systems. Paying attention to this face, the present invention is characterized in that an office pulls, before the connection of a subscriber line to an xDSL system, the subscriber line at the outside line of an xDSL circuit, measures the cross-talk noise characteristic of the subscriber line, and prevents, if the cross-talk noise characteristic is of high level, the subscriber line from being connected to the xDSL circuit.

[0008]

Also, in accordance with the present invention, the noise level determined by the measurement is compared with a template for thereby determining whether or not the xDSL subscriber circuit can be connected. Connection to a circuit where the deterioration of the characteristic is estimated beforehand is inhibited to thereby avoid the deterioration.

[0009]

More specifically, in transmission via a subscriber line using xDSL, the present invention obviates the deterioration of a characteristic ascribable to noise leaking an ISDEN circuit, another xDSL circuit or similar high-speed circuit. For this purpose, before the connection of an xDSL subscriber system, the present invention pulls a subscriber outside line with a pull relay for testing, differentially produces an AC voltage between, e.g., lines with a voltage measuring section, and converts the AC voltage to a digital signal having a preselected sampling rate.

[0010]

The digital signal is subjected to fast Fourier transform and converted to a noise spectrum thereby, so that a noise level at a subject portion is measured. Subsequently, the noise level thus measured is compared with a template (threshold value) prepared by experiments paying attention to a frequency band in which the transmission characteristic is noticeably deteriorated. Whether or not the xDSL subscriber line can be connected is determined on the basis of the result of the above comparison.

[0011]

[Embodiment of the Invention]

FIG. 1 is a schematic block diagram showing an embodiment of the system for selecting an xDSL channel suffering from a minimum of cross-talk noise in accordance with the present invention.

[0012]

As shown, the system includes an MDF (Main Distribution Frame) 11 connected to outside line terminals T and R at the subscriber side. Relays 12 implement test drops and deliver noise voltages on xDSL channels to a testing system. The testing system is made up of a voltage measuring circuit 13, an ADC (Analog-to-Digital Converter) circuit 14, an FFT circuit 15 for effecting fast Fourier transform, and a controller 16. The voltage measuring circuit 13 measures the noise voltages delivered from the test-drop relays 12. The ADC circuit 14 converts the measured voltages to digital signals. The FFT circuit 15 executes FFT with the digital signals. The controller 16 determines whether or not the individual xDSL channel is usable.

[0013]

In FIG. 1, a cross-talk noise level on the outside line terminals T and R at the subscriber side is differentially input to the testing system via the MDF 11 and test-drop relays 12 in the form of an AC voltage between wires. In the testing system, the voltage measuring circuit 13 has a function of amplifying the level of an input signal. The voltage measuring circuit 13 amplifies the cross-talk noise voltage and then feeds the amplified noise voltage to the ADC circuit 14.

[0014]

The ADC circuit 14 converts the noise voltage to a digital signal by using a preselected sampling frequency and feeds the digital signal to the FFT circuit 15. The FFT circuit 15 transforms the digital signal to noise spectrum data by FFT. The controller 16 compares the noise spectrum data with a template, which is weighted at a subject frequency, to thereby determine whether or not the channel is usable.

[0015]

More specifically, the controller 16 makes the above decision while controlling the voltage measuring circuit 13, ADC circuit 14 and FFT 15. If the result of decision shows that deterioration is estimated in the characteristic of the xDSL channel, then the controller 16 selects another channel whose characteristic is not deteriorated. This is successful to improve the transmission characteristic of the entire xDSL system.

[0016]

[Effects of the Invention]

In summary, in accordance with the present invention, a testing system installed in an office measures the noise level of a subject port before a subscriber line is connected to an xDSL channel. The testing system can therefore determine the condition of the subscriber line in a short period of time.

[0017]

Further, whether or not to connect the subscriber line to the xDSL channel can be determined by a relatively simple configuration on the basis of estimated deterioration. This successfully avoids the deterioration of characteristic ascribable to cross-talk noise beforehand.

[Brief Description of the Drawings]

[FIG. 1]

is a block diagram schematically showing a system for selecting a low noise level, xDSL channel embodying the present invention.

[FIG. 2]

shows specific frequency bands assigned to a DMT xDSL system and other communication systems available in Japan.

[List of Reference Numerals]

11 MDF

12 relay for test

13 voltage measuring circuit

14 ADC circuit

15 FFT circuit

16 controller

[Document Name] ABSTRACT OF THE DISCLOSURE

[Abstract]

[Problem] To provide means for easily confirming the characteristics of the individual xDSL channel without resorting to any change or modification of an xDSL transmission system.

[Solving Means] A system of the present invention is connected to a voltage measuring circuit 13 via an MDF (Main Distribution Frame) 11, which is connected to outside line terminals T and R at the subscriber side, and relays 12 adapted for test pulling. The voltage measuring circuit 13, having an amplifying function for adjusting the level of a received signal, is connected to an ADC circuit 14. A controller 16 is connected to the ADC circuit 14 and causes an FFT circuit 15 to convert a digital signal output from the ADC circuit 14 with a preselected sampling frequency to a noise spectrum, and compares the noise spectrum with a template for noise level decision weighted at a subject frequency for thereby determining whether or not a line is usable.

[Figure Selected] FIG. 1

implement test drops and deliver noise voltages on xDSL channels to a testing system. The testing system is made up of a voltage measuring circuit 13, an ADC (Analog-to-Digital Converter) circuit 14, an FFT circuit 15 for effecting fast Fourier transform, and a controller 16. The voltage measuring circuit 13 measures the noise voltages delivered from the test-drop relays 12. The ADC circuit 14 converts the measured voltages to digital signals. The FFT circuit 15 executes FFT with the digital signals. The controller 16 determines whether or not the individual xDSL channel is usable.

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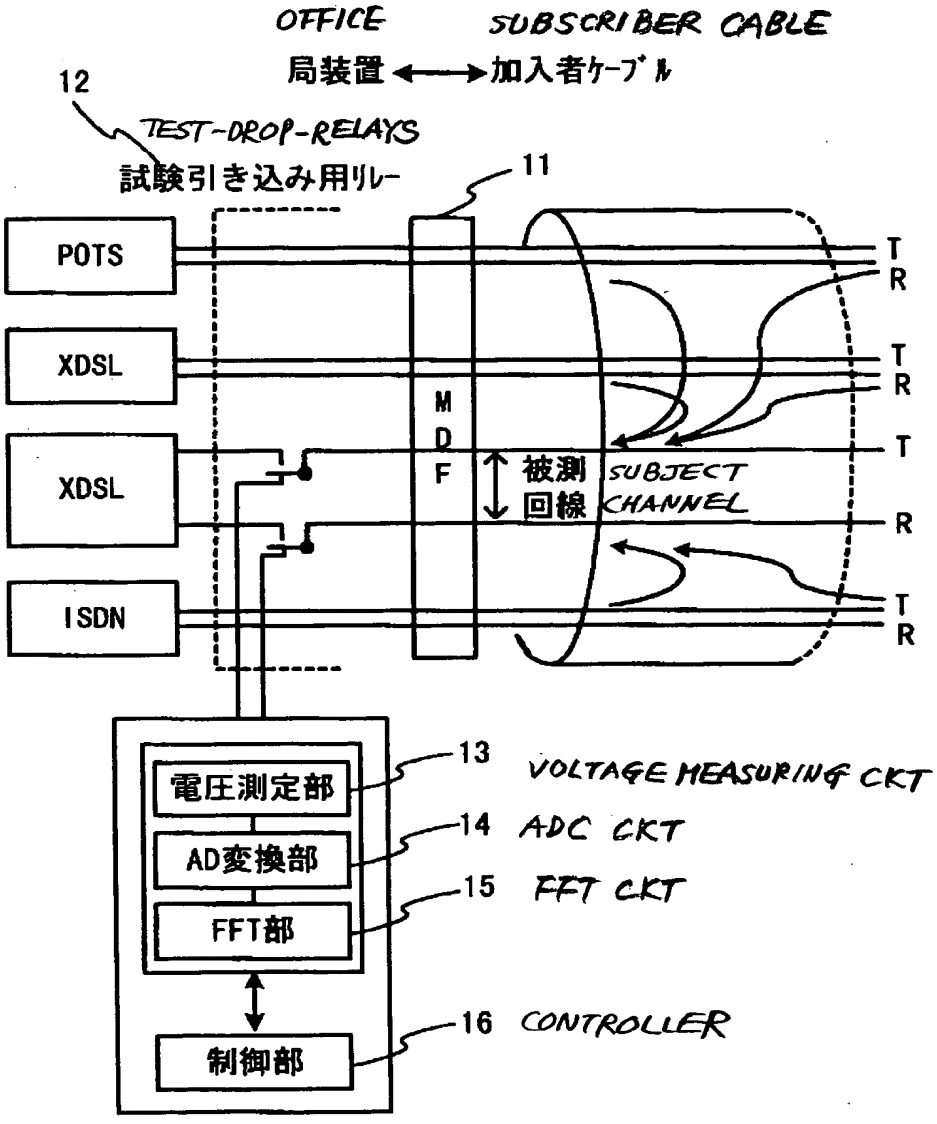
【書類名】　図面

N-01021

【図１】



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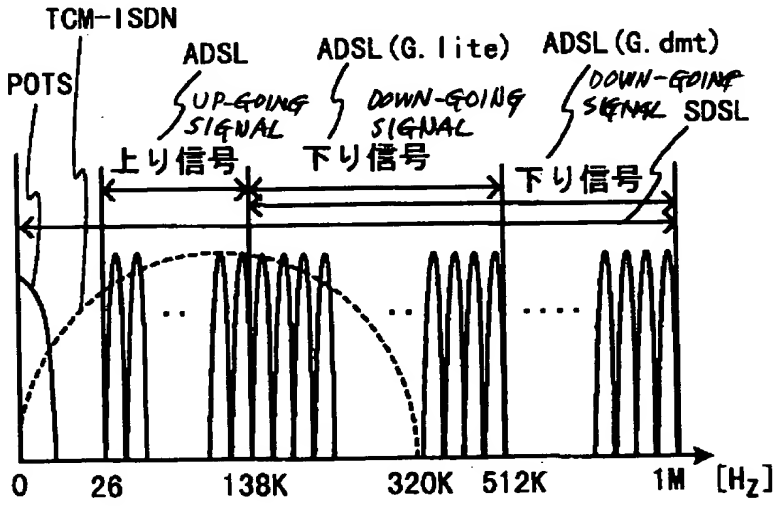
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